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मानक

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“पुराने को छोड़ नये के तरफ”

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“Step Out From the Old to the New”

IS 12273 (1987): Industrial Oil Fired Burners [MED 17:
Chemical Engineering Plants and Related Equipment]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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*Indian Standard*SPECIFICATION FOR
INDUSTRIAL OIL FIRED BURNERS

1. Scope — Specifies requirements of low air pressure atomizing (LAP) type burners for use with fuel oil in accordance with IS : 1593-1982 'Specification for fuel oils (second revision)', using air from 600 to 1 600 mm WG.

2. Size — The burners shall be classified based on sizes as given below:

- | | | |
|-----------|---|---------------|
| a) Size 1 | : | Up to 10 kg/h |
| b) Size 2 | : | 11-20 kg/h |
| c) Size 3 | : | 21-40 kg/h |
| d) Size 4 | : | 41-60 kg/h |
| e) Size 5 | : | 61-100 kg/h |
| f) Size 6 | : | 101-200 kg/h |
| g) Size 7 | : | 201-400 kg/h |

3. Material

3.1 The burner parts/casing shall conform to grade FG 200 of IS : 210-1978 'Specification for grey iron castings (third revision)' or grade 04Cr18N:11 of IS : 1570 (Part 5)-1972 Schedules for wrought steels for general engineering purposes: Part 5 Stainless and heat resisting steels (first revision).

3.2 Primary and secondary air cones and burner nozzle shall be of the material which withstands back radiation from the operating furnace.

4. Fabrication — Burner parts like oil gun, primary and secondary air passages inside the burner, and primary and secondary air cones, shall be concentric and the concentricity shall not get disturbed during normal usage.

5. Performance

5.1 Burner Capacity — The maximum capacity (kg/h) of the burner shall be fixed and printed on the burner body by the manufacturer. Variation on maximum capacity shall be within ± 5 percent when tested as detailed in Appendix A.

5.2 Furnace Test — The burner when tested as specified in Appendix B, shall give the following performance (Bacharach method of smoke test is given in Appendix C).

Size	1	2	3	4	5	6	7
Turn down ratio	3	3	5	5	5	5	5
Excess air (% of stoichio- metric quantity), Max	20	20	20	20	20	20	20
CO, Max	←-----100 ppm-----→						
Bacharach smoke No.	←-----3-----→						
Fuel dripping	←-----Absent-----→						
Coking in burner block	←-----Absent-----→						
Coking of fuel nozzle	←-----Absent-----→						

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6. Marking — Each burner shall be marked with the following information:

- a) Manufacturer's name or trade-mark,
- b) Size of burner, and
- c) Year of manufacture.

6.1 Standard Marking — Details available with the Bureau of Indian Standards.

A P P E N D I X A

(*Clause 5.1*)

BURNER CAPACITY TEST

A-1. Procedure

A-1.1 Install the burner with its nozzle facing vertically downwards on the burner stand as shown in Fig. 1. Heat the HV grade fuel oil of IS : 1593-1982 in the service tank to a temperature of 50°C. Let the fuel flow through the burner with another receiver tank. Gradually adjust the heater so that the fuel temperature at dial thermometer stabilizes at 110°C (for a temperature corresponding to viscosity less than 25 centistokes). Adjust the flow of fuel oil through the burner with the help of valves such that the pressure gauge indicates the pressure as recommended by the manufacturer. Let the oil flow for 15 minutes under stabilized conditions as indicated by dial thermometer and pressure gauge. Cover the receiver tank with lid and put a graduated vessel abruptly to collect the fuel oil. Simultaneously, start/stop watch and collect the fuel oil for the time duration as indicated below:

Size 1	30 minutes, <i>Min</i>
Size 2	15 minutes, <i>Min</i>
Size 3	10 minutes, <i>Min</i>
Size 4	10 minutes, <i>Min</i>
Size 5	10 minutes, <i>Min</i>
Size 6	10 minutes, <i>Min</i>
Size 7	10 minutes, <i>Min</i>

A-1.2 Find the weight of fuel oil collected and calculate the capacity as follows:

Let w = weight of fuel oil collected in kg, and

t = time in minutes.

Then capacity in kg/h = $\frac{w}{t} \times 60$

A-1.3 Repeat the test to get the value of capacity in kg/h within a variation of 5 percent.

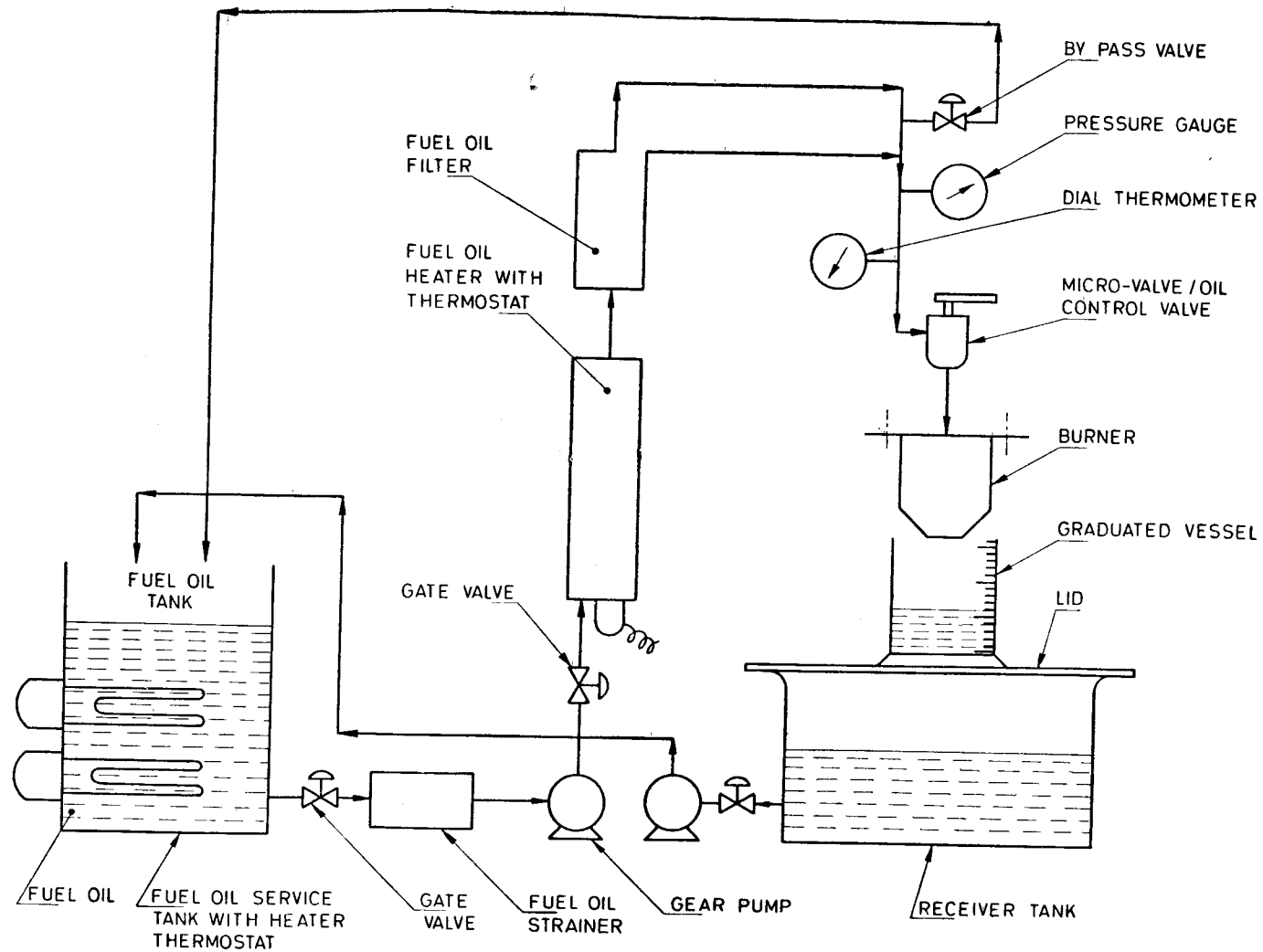


FIG. 1 BURNER CAPACITY TEST

APPENDIX B

(Clause 5.2)

FURNACE TEST

B-1. The test set up is shown in Fig. 2. The internal dimensions of the furnace shall be such that the flame does not impinge. For guidance the following table shall be used:

Selection of Furnace Size

<i>Burner Size</i>	<i>Furnace Diameter (D)</i> mm	<i>Length</i> mm
Size 1	600	600
Size 2	600	1 200
Size 3	600	1 800
Size 4	900	2 400
Size 5	900	3 600
Size 6	900	4 800
Size 7	1 000	6 000

B-2. Procedure

B-2.1 Install the burner with burner block as supplied and recommended by the manufacturer.

B-2.2 Heat the HV grade fuel oil of IS : 1593-1982 in the fuel oil service tank up to 50°C and circulate the fuel oil through strainer pump, heater, filter and back to the service tank through bypass. Adjust so that the equipment and line gets heated up. Light the burner in accordance with the directions of the manufacturer.

B-2.3 Adjust the thermostat of the final stage heater so that the temperature at the dial thermometer is $110 \pm 5^\circ\text{C}$ (or a temperature corresponding to viscosity less than 25 centistokes).

B-2.4 Fix fuel oil rate equal to the capacity of burner as estimated with the help of microvalve, bypass valve and burner valve by adjusting required pressure at the pressure gauge and check the firing rate with the help of methods like dipstick or flow meters.

B-2.5 Adjust secondary air with the help of control valve and pressure gauge (manometer) as to get bacharach smoke density number 3.

B-2.6 Adjust the damper to get a positive pressure about 1.5 mm of water gauge in the middle of the furnace.

B-2.7 Let the burner operate for sometime till the temperature indicated by the thermocouples fitted in the wall of the furnace stabilizes above 1 000°C.

B-2.8 Re-adjust the quantity of secondary air to get bacharach smoke density number 3 in the chimney.

B-2.9 Analyze the products of combustion in the chimney for CO_2 , CO and O_2 with the use of the following instruments:

- Infra red gas analyzer, Orsat or Fyrite, for CO_2 and O_2 ; and
- Infra red gas analyzer for CO.

B-2.10 Calculate the quantity of excess air as percentage of stoichiometric air.

B-2.11 Reduce the fuel firing rate to 1/3 and 1/5 in case of burners of sizes 1, 2 and 3-7, respectively. Re-adjust the secondary air and damper to get 3 bacharach smoke number and 1.5 mm WG draft in the furnace. Let the burner operate at reduced firing rate till the temperature indicated by the thermocouple stabilizes. Re-check the bacharach smoke number and draft and analyze the exhaust gas.

B-2.12 Note for choking of fuel passages and coking in the burner block during test.

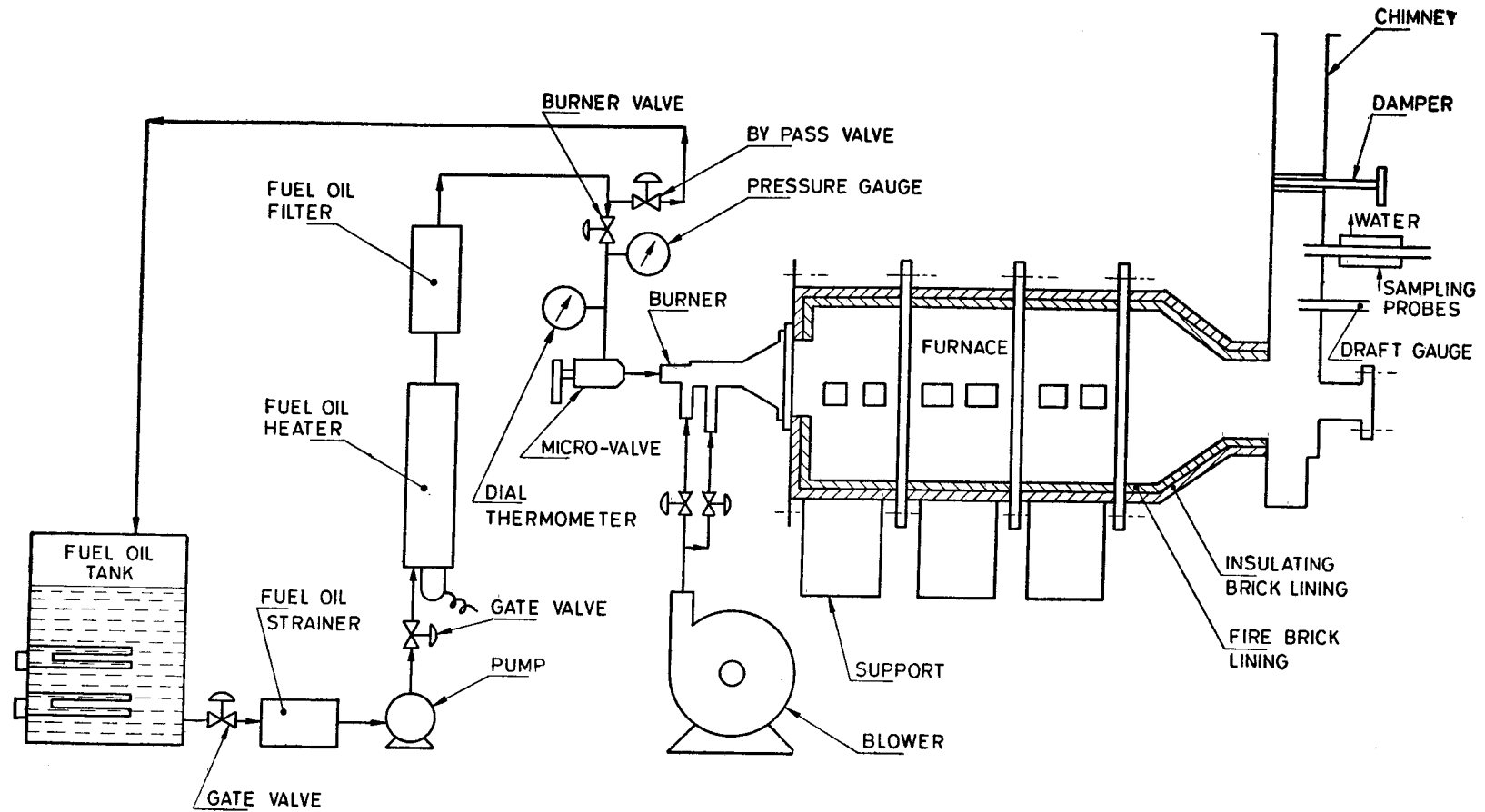


FIG. 2 FURNACE TEST

APPENDIX C

(Clause 5.2)

BACHARACH METHOD OF SMOKE TEST

C-0. General — This method covers the evaluation of smoke spot numbers in the flue gases from burning liquid fuels. The smoke density/number is measured by the smoke scale shown in Fig. 3. This is an important reading.

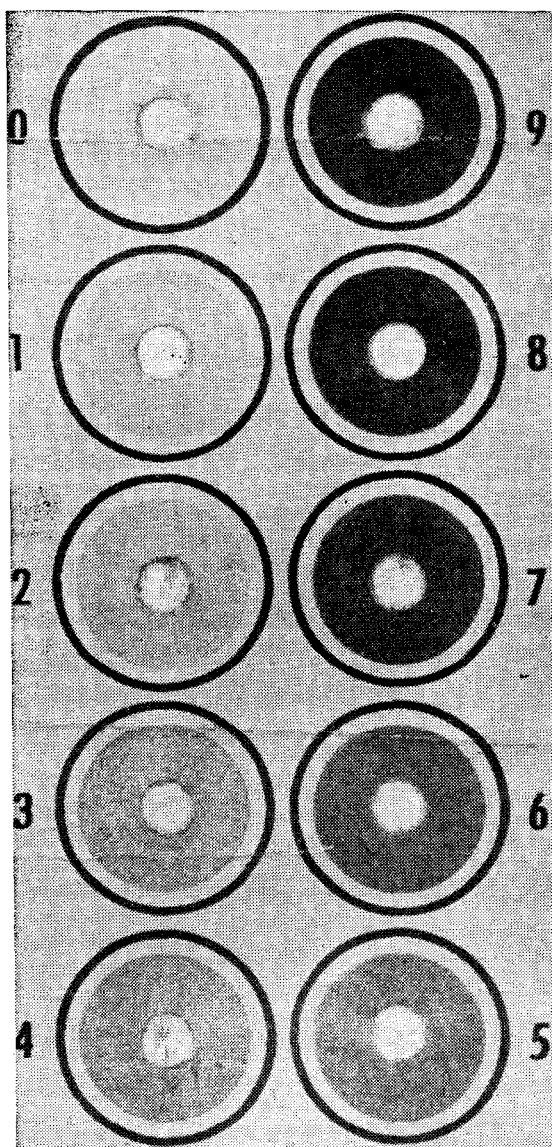


FIG. 3 BACHARACH BURNER SMOKE SCALE

C-1. Summary of Method — A test smoke spot is obtained by pulling a fixed volume of flue gas through a fixed area of standard filter paper. The shade of the spot thus produced is visually matched with a standard scale (Fig. 3) and smoke density is expressed as a 'smoke spot number'.

C-2. Significance — This method provides a means of controlling smoke production to an acceptable level while burning liquid fuels. A high smoke density/number reading affects efficiency due to deposit of soot and unburnt fuel passing up the chimney in the form of vapour.

C-2.1 Carbondioxide adjustment has to be made in relation to the amount of smoke density produced.

C-2.2 Table below shows the effect of smoke on burner performance.

Effect of Smoke on Burner Performance

<i>Smoke Spot Number</i>	<i>Rating</i>	<i>Sooting Produced</i>
1	Excellent	Extremely light, if at all
2	Very good	Slight sooting which will not increase stack temperature appreciably
3	Good	May be some sooting but will rarely require cleaning more than once a year
4	Fair	Border line condition; some units will require cleaning more than once a year
5	Poor	Soot rapidly and heavy

C-3. Apparatus

C-3.1 Sampling Device — A suitable device (smoke meter) providing a total flue gas sample volume of $0.4000 \pm 0.0016 \text{ m}^3$ (at 15°C , 1 atm) for each 6.5 cm^2 effective surface area of filter paper is employed. The sampling device and connections shall be of such a construction that the total travel of flue gas sample from flue to filter paper shall be minimum. The device shall provide for cooling the sample below the charring temperature for the filter paper but not below the dew point of the sample.

C-3.2 Smoke Scale (Fig. 3) — The smoke scale required consists of ten spots numbered from 0 to 9, ranging in equal photometric steps from white through neutral shades or grey to black, imprinted or otherwise, processed on white paper or plastic stock having a surface reflectance of between 82.5 and 87.5 percent 45° , 0° in light luminous directional reflectance.

C-4. Materials

C-4.1 Test Filter Paper — It shall be made from white filter paper stock having a surface reflectance of 82.5 to 87.5 percent 45° , 0° daylight luminous directional reflectance.

C-5. Procedure

C-5.1 The test set up is shown in Fig. 4.

C-5.2 The procedure recommended by the equipment manufacturer shall be rigidly followed.

C-5.3 Start the vacuum pump and turn the three-way cock so that the flue gas is sucked through cooler.

C-5.4 Adjust the water flow through the cooler so that the temperature of the flue gas sample being sucked is below the charring temperature of filter paper and much above dew point.

C-5.5 Insert the filter paper in the sampler and tighten the filter paper holder. Connect the sampling device to the flue gas probe and turn the cock in a position such that the gas passage to vacuum pump is closed and passage to the smoke meter is opened.

C-5.6 Draw the required sample. In sampling, be sure to pull piston through 10 full strokes and hold for several seconds at the end of each pull stroke. On pull stroke, use a steady pull motion such that a full stroke is obtained in 3 or 4 seconds.

C-5.7 Remove the filter paper. Compare the test spot with smoke scale.

C-5.8 For maximum accuracy, hold smoke scale at arm's length from eyes when comparing with smoke spot on filter paper.

C-5.9 Keep smoke scale clean and store in envelope provided when not in use.

C-6. Report — Report the smoke density as the smoke spot number on the standard scale most closely corresponding to the test spot. Interpolate differences between two standard smoke spot numbers to the nearest half number. Repeat smoke spot numbers higher than 3 as 'Greater than No. 3'.

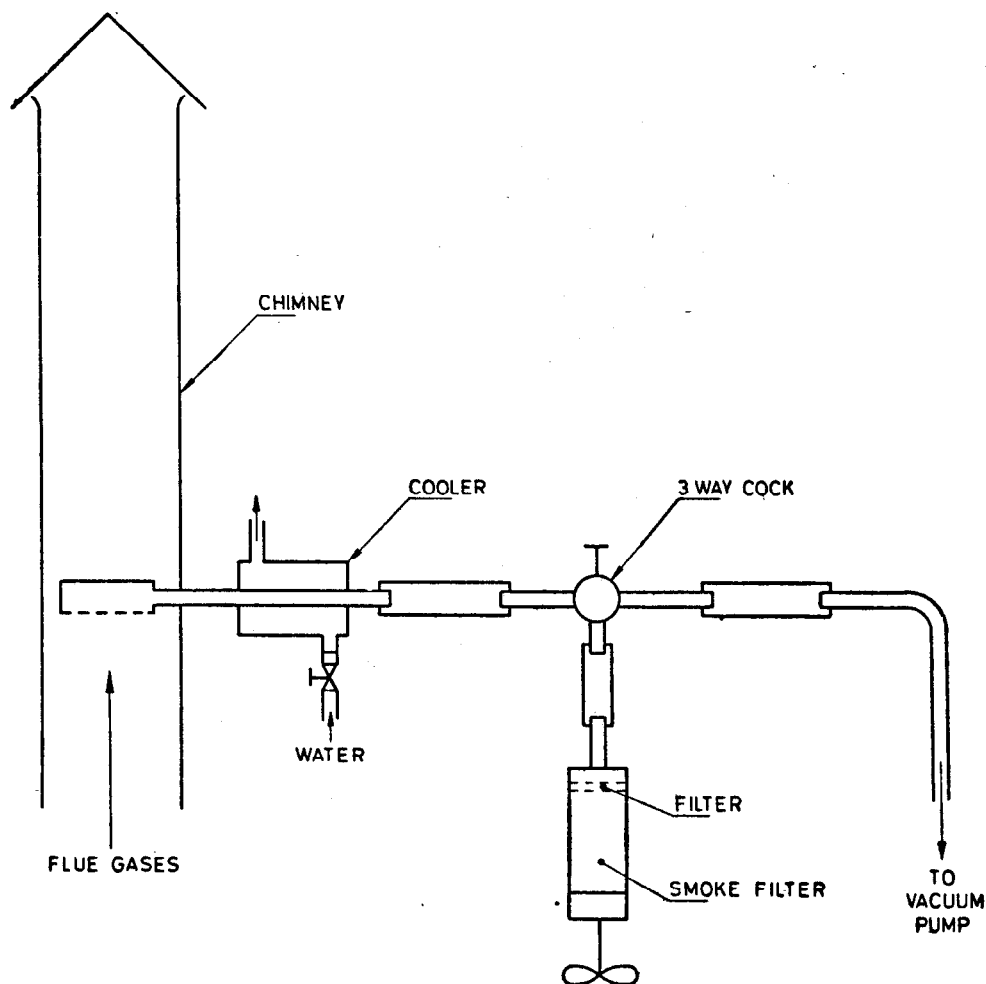


FIG. 4 METHOD FOR DETERMINATION OF BACHARACH SMOKE DENSITY NUMBER

EXPLANATORY NOTE

Oil fired burners are used in industrial furnaces, petroleum refineries, power generation, etc. HV grade fuel oil as per IS : 1593-1982 is used for these applications. In these applications firing rate, excess air requirements, wider turn down ratios, emissivity and temperatures are important.

One of the methods to bring about fuel oil conservation in the industry is to weed out inefficient oil fired burners. This standard specifies the performance requirements of low air pressure atomizing (LAP) type oil fired burners which will help in conservation of fuel oil.

In the preparation of this standard, assistance has been derived from CEGB standard 806402 'Performance of industrial oil fired burners', issued by the Central Electricity Generating Board, United Kingdom.